

Claims

1. A method of manufacturing a spin valve film comprising the steps of:
forming an undercoat film on a substrate;
forming, on said undercoat film, a first ferromagnetic film serving as a free layer;
forming an electrically conductive film on said first ferromagnetic film;
forming, on said electrically conductive film, a second ferromagnetic film serving as a pinned layer; and
forming an antiferromagnetic film on said second ferromagnetic film;
wherein during a process for forming said undercoat film, first ferromagnetic film, electrically conductive film and second ferromagnetic film constituting the spin valve film, after a completion of a previous film making process for forming a previous film of two films to be formed successively, but before an initiation of a succeeding film making process for forming a succeeding film, a step of decreasing an anisotropic magnetic field of the spin valve film by interrupting a film making process is introduced.
2. The method of manufacturing a spin valve film according to claim 1, wherein the films constituting the spin valve film are formed by sputtering, molecular beam epitaxy or vapor deposition while the substrate is set in a film forming vacuum chamber.
3. The method of manufacturing a spin valve film according to claim 2, wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field of the spin valve film by interrupting a film making process is carried out while the substrate is kept in said film forming vacuum chamber.
4. The method of manufacturing a spin valve film according to claim 3, wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field is performed by exposing the substrate to plasma which does not accompany a film formation.
5. The method of manufacturing a spin valve film according to claim 3, wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field is conducted by flowing a process gas.
6. The method of manufacturing a spin valve film according to claim 3,

wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field is conducted by a surface treatment with a gas containing H₂O or O₂ by a concentration not less than 1 ppm.

7. The method of manufacturing a spin valve film according to claim 2, wherein after finishing the previous film forming step within said film forming vacuum chamber, the substrate is transferred into a separate vacuum chamber and said step of decreasing an anisotropic magnetic field by interrupting the film making process is performed, and then the substrate is returned into said film forming vacuum chamber and the succeeding film forming step is performed.

8. The method of manufacturing a spin valve film according to claim 7, wherein after finishing the previous film forming step, the substrate is transferred into said separate vacuum chamber and said step of reducing an anisotropic magnetic field is carried out by exposing the substrate to a plasma which does not accompany film formation.

9. The method of manufacturing a spin valve film according to claim 7, wherein after finishing the previous film forming step, the substrate is transferred into said separate vacuum chamber, and said step of decreasing an anisotropic magnetic field is conducted by flowing a process gas.

10. The method of manufacturing a spin valve film according to claim 7, wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field is performed by transferring the substrate into said separate vacuum chamber whose degree of vacuum is lower than that of the film forming vacuum chamber.

11. The method of manufacturing a spin valve film according to claim 7, wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field is conducted by transferring the substrate into said separate vacuum chamber having higher H₂O or O₂ concentration than said film forming vacuum chamber.

12. The method of manufacturing a spin valve film according to claim 7, wherein after finishing the previous film forming step, the substrate is transferred into said separate vacuum chamber, and said step of decreasing an anisotropic magnetic field is carried out by subjecting the substrate to a surface treatment with a gas containing H₂O or O₂ with a concentration not less than 1 ppm.

13. A method of manufacturing a spin valve film comprising the steps of:
forming an undercoat film on a substrate;
forming an antiferromagnetic film on said undercoat film;
forming, on said antiferromagnetic film, a first ferromagnetic film serving as a pinned layer;
forming an electrically conductive film on said first ferromagnetic film; and
forming, on said electrically conductive film, a second ferromagnetic film serving as a free layer;
wherein during a process for forming said first ferromagnetic film, electrically conductive film and second ferromagnetic film constituting the spin valve film, after a completion of a film making process for forming a previous film of two films to be formed successively, but before an initiation of a film making process for forming a succeeding film of said two films, a step of decreasing an anisotropic magnetic field of the spin valve film by interrupting a film making process is introduced.

14. The method of manufacturing a spin valve film according to claim 13, wherein the films constituting the spin valve film are formed by sputtering, molecular beam epitaxy or vapor deposition while the substrate is set in a film forming vacuum chamber.

15. The method of manufacturing a spin valve film according to claim 14, wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field of the spin valve film by interrupting a film making process is carried out while the substrate is kept in said film forming vacuum chamber.

16. The method of manufacturing a spin valve film according to claim 15, wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field is performed by exposing the substrate to plasma which does not accompany a film formation.

17. The method of manufacturing a spin valve film according to claim 15, wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field is conducted by flowing a process gas.

18. The method of manufacturing a spin valve film according to claim 15, wherein after finishing the previous film forming step, said step of decreasing an

anisotropic magnetic field is conducted by a surface treatment with a gas containing H₂O or O₂ with a concentration not less than 1 ppm.

19. The method of manufacturing a spin valve film according to claim 14, wherein after finishing the previous film forming step within said film forming vacuum chamber, the substrate is transferred into a separate vacuum chamber and said step of decreasing an anisotropic magnetic field by interrupting the film making process is performed, and then the substrate is returned into said film forming vacuum chamber and the succeeding film forming step is carried out.

20. The method of manufacturing a spin valve film according to claim 19, wherein after finishing the previous film forming process, the substrate is transferred into said separate vacuum chamber and said step of reducing an anisotropic magnetic field is carried out by exposing the substrate to a plasma which does not accompany film formation.

21. The method of manufacturing a spin valve film according to claim 19, wherein after finishing the previous film forming step, the substrate is transferred into said separate vacuum chamber, and said step of decreasing an anisotropic magnetic field is conducted by flowing a process gas.

22. The method of manufacturing a spin valve film according to claim 19, wherein after finishing the previous film forming step, the substrate is transferred into said separate vacuum chamber, and said step of decreasing an anisotropic magnetic field is carried out by subjecting the substrate to a surface treatment with a gas containing H₂O or O₂ with a concentration not less than 1 ppm.

23. The method of manufacturing a spin valve film according to claim 19, wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field is performed by transferring the substrate into said separate vacuum chamber whose degree of vacuum is lower than that of the film forming vacuum chamber.

24. The method of manufacturing a spin valve film according to claim 19, wherein after finishing the previous film forming step, said step of decreasing an anisotropic magnetic field is conducted by transferring the substrate into said separate vacuum chamber having higher H₂O or O₂ concentration than said film forming vacuum chamber.

25. A method of manufacturing a thin film magnetic head including a step

of forming a magnetoresistive type reading element having a spin valve film before or after forming an inductive type writing element such that the writing element is supported by a substrate, and said step comprising the steps of:

- forming an undercoat film on said substrate;

- forming, on said undercoat film, a first ferromagnetic film serving as a free layer;

- forming an electrically conductive film on said first ferromagnetic film;

- forming, on said electrically conductive film, a second ferromagnetic film serving as a pinned layer; and

- forming an antiferromagnetic film on said second ferromagnetic film;

whereby during a process for forming said undercoat film, first ferromagnetic film, electrically conductive film and second ferromagnetic film constituting the spin valve film, after a completion of a previous film making process for forming a previous film of two films to be formed successively, but before an initiation of a succeeding film making process for forming a succeeding film, a step of decreasing an anisotropic magnetic field of the spin valve film by interrupting a film making process is introduced.

26. A method of manufacturing a thin film magnetic head including a step of forming a magnetoresistive type reading element having a spin valve film before or after forming an inductive type writing element such that the writing element is supported by a substrate, and said step comprising the steps of:

- forming an undercoat film on said substrate;

- forming an antiferromagnetic film on said undercoat film;

- forming, on said antiferromagnetic film, a first ferromagnetic film serving as a pinned layer;

- forming an electrically conductive film on said first ferromagnetic film; and

- forming, on said electrically conductive film, a second ferromagnetic film serving as a free layer;

whereby during a process for forming said first ferromagnetic film, electrically conductive film and second ferromagnetic film constituting the spin valve film, after a completion of a film making process for forming a previous film of two films to be formed successively, but before an initiation of a film making process for forming a succeeding film of said two films, a step of decreasing an

anisotropic magnetic field of the spin valve film by interrupting a film making process is introduced.

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